Effect of Number of Clinics and Panel Size on Patient Continuity for Medical Residents

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Abstract

Background Accreditation Council for Graduate Medical Education program requirements for internal medicine residency training include a longitudinal, continuity experience with a panel of patients.

Objective To determine whether the number of resident clinics, the resident panel size, and the supervising attending physician affect patient continuity. To determine the number of clinics and the panel size necessary to maximize patient continuity.

Design We used linear regression modeling to assess the effect of number of attended clinics, the panel size, and the attending physician on patient continuity.

Participants Forty medicine residents in an academic medicine clinic.

Measurements Percent patient continuity by the usual provider of care method.

Results Unadjusted linear regression analysis showed that patient continuity increased 2.3% ± 0.7% for each additional clinic per 9 weeks or 0.4% ± 0.1% for each additional clinic per year ($P = .003$). Conversely, patient continuity decreased 0.7% ± 0.4% for every additional 10 patients in the panel ($P = .04$). When simultaneously controlling for number of clinics, panel size, and attending physician, multivariable linear regression analysis showed that patient continuity increased 3.3% ± 0.5% for each additional clinic per 9 weeks or 0.6% ± 0.1% for each additional clinic per year ($P < .001$). Conversely, patient continuity decreased 2.2% ± 0.4% for every additional 10 patients in the panel ($P < .001$). Thus, residents who actually attend at least 1 clinic per week with a panel size less than 106 patients can achieve 50% patient continuity. Interestingly, the attending physician accounted for most of the variability in patient continuity (51%).

Conclusions Patient continuity for residents significantly increased with increasing numbers of clinics and decreasing panel size and was significantly influenced by the attending physician.

Introduction

Continuity of care is beneficial to patients, physicians, and the health care system as a whole.[1] Greater continuity of care leads to greater satisfaction for patients and a more complete educational experience for resident physicians.[2–5] Ambulatory care training provides residents the opportunity to develop skills in interacting with patients over time and in treating chronic conditions.[6–9] The Residency Review Committee for Internal Medicine of the Accreditation Council of Graduate Medical Education (ACGME) also places value on continuous, healing relationships in the outpatient setting and has increased the required number of continuity clinics for medicine residents from 108 to 130 during their 3 years of training.[10] However, there is no evidence that establishes the optimal number of clinics and the optimal panel size for an internal medicine resident at each level of training. Realistic goals for resident-patient continuity in the ambulatory setting have not been well defined.

Despite the advantages of continuity of care, resident physicians find it difficult to maintain continuity with their patients because of competing demands from in-hospital and subspecialty rotations as well as residency work hour restrictions.[11] Although ACGME regulations regarding resident work hours may reduce fatigue-related errors, it is interesting to note that residents feel more errors occur because of less continuity of care.[5,12] Thus, there is a need to determine how residency programs can optimize patient continuity in the face of these competing demands. There

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has been prior research on continuity of care from the perspective of residents, and this research demonstrated that increased continuity for residents is correlated with increased number of resident clinics.[13] Consistent with the goal of patient-centered care espoused by the Institute of Medicine and by the ACGME, we decided to focus on continuity of care from the perspective of patients rather than residents. Indeed, the recent study demonstrating that improved patient continuity is associated with improved hemoglobin A_{1c} levels in patients with diabetes underscores the importance of understanding how we can enhance patient continuity for our residents.[14] We hypothesized that continuity of care for patients would depend on the number of resident clinics and the resident panel size as well as the attending physician assigned to each resident.

Methods

Study Population and Setting

The internal medicine residency program at Southern Illinois University averages 12 categorical medicine and 2 combined medicine/psychiatry residents per year. Data were reviewed retrospectively for all residents during the study period. First- and second-year residents have 1 continuity clinic per week, while third-year residents have 2 clinics per week with the same attending physician. Residents attend only 1 continuity clinic per month when they rotate on intensive care unit rotations.

Residents serve as primary care physicians for their own panel of patients, and each resident is assigned to a single attending faculty member for the duration of their residency. Each June, residents are assigned a patient panel that includes patients from their previous panel as well as patients who are reassigned to them from, for example, departing residents. Throughout the year, patients are added to the panel as residents see new outpatient consults and hospital follow-up patients.

Faculty members mentor residents during their clinic and provide backup for their patients when residents are not available in the clinic. Faculty members supervise 2 to 7 residents per year. Faculty members are grouped into 3 teams along with their residents. If a patient needs an appointment but the primary resident is not available, the patient may be seen by any provider on the resident/attending team based on availability. At the time of the study, resident panel size was left to the discretion of the attending supervisor, resulting in wide variation.

With the exception of 1 attending physician who is also a geriatrician (but who does not have a specific geriatric clinic), patients with specific disorders are not targeted toward particular residents or attending physicians. The top 10 diagnoses are hypertension, hyperlipidemia, diabetes, coronary artery disease, esophageal reflux, depression, allergic rhinitis, hypothyroidism, low back pain, and chronic obstructive pulmonary disease. Payor mix by charges for the practice in 2007 was 50% Medicare and Medicaid, 40% private insurance, and 9% self-pay. Historical data for the clinic show that, on average, patients are seen 2.5 times per year.

Study End Points

We used the usual provider of care method as our study end point.[15] This is a patient-centric method of evaluating continuity based on the percentage of time patients see their own resident provider rather than the percentage of time residents see their own patients. Specifically, in this method, continuity is the percentage based on the number of panel patient visits seen by the assigned resident compared with the total number of visits to the general internal medicine clinic by panel patients (both seen by the assigned resident and any other providers). We obtained these data through the electronic appointment system (OAS Gold, Siemens Medical Solutions Health Services Corporation, Malvern, Pennsylvania).

Study Time Frame and Variables

We examined a 9-week period starting on March 1, 2007. We chose this period because it is a relatively stable time in the yearly academic cycle. This period avoids the first few months when first-year residents are starting their clinics, and it avoids holidays, which typically result in the cancellation of clinics. Thus, this time likely represents the optimum period for patient continuity in a resident clinic. We counted the actual number of clinics attended by each resident during this time rather than relying on the theoretical schedule because resident clinics are cancelled for a variety of reasons, such as when they conflict with residency work rule requirements. Because we considered the possibility that percent patient continuity could vary depending on the assigned attending physician, we used indicator variables for each attending physician in our multivariable model, as will be discussed. Our institutional review board determined that this work was exempt because it was designated as a quality-improvement project.

Statistical Analysis

We used linear regression to analyze the independent influence of the number of clinics, the panel size, and the attending physician on the percent continuity for patients. The r^2 analysis was used to determine how much variability in percent continuity for patients could be explained by each variable analyzed independently. Regression diagnostics included analysis for residuals, influence, and leverage. We found 1 resident who had significant leverage, so as a sensitivity analysis, we separately analyzed our data without this resident. Four months before this study, 6 residents were reassigned to new attending physicians and began to develop a new panel of patients. We therefore did a separate sensitivity analysis with those residents removed from the dataset.

We used β coefficients from the linear models to determine the number of clinics and the panel size necessary to achieve 50% continuity for patients. We then analyzed

TABLE 1 **Unadjusted Analysis of Resident Continuity**[a]

Variable	Intercept	β Coefficient	*P* Value	r^2
Clinics	28.9 ± 6.1			0.215
Number per 9 weeks		2.3 ± 0.7	.003	
Number per week		20.9 ± 6.5	.003	
Number per year		0.4 ± 0.1	.003	
Panel size (number of patients)	54.7 ± 4.1	−0.07 ± 0.04	.04	0.103
Attending physician			.001	0.507

[a] Plus and/or minus values are means ± standard error.

these variables together in multivariable linear models so that we could assess the impact of each variable on the percent continuity for patients while simultaneously controlling for the other variables. In 1 model we included the number of clinics and the panel size; in the other model we added indicator variables for the attending physicians. We additionally assessed whether there was effect modification between number of clinics and panel size by using a multiplicative interaction term, but this term was not significant. Thus, we can evaluate number of clinics and panel size independently of each other. Similarly, year of residency was not significant and therefore not included in the final model. We used the number of clinics and the panel size that were estimated to achieve a 50% patient continuity from the unadjusted analyses to determine whether these same numbers would achieve a 50% continuity for patients in our multivariable model that contains both of these variables as well as the attending physicians. Because third-year residents have an additional clinic per week, we used a Wilcoxon rank sum test to compare the median patient continuity of those attending more than 1 clinic per week to those attending 1 clinic or less per week. We used SAS 9.1 to perform all statistical analysis (SAS Institute Inc, Cary, North Carolina).

Results

During this 9-week study, 40 participating residents attended a median of 7.0 (interquartile range [IQR], 6.0–9.5) clinics and had a median panel size of 98 (IQR, 57–120) patients. Overall, these residents achieved a median 47.5% (IQR, 37.9%–56.4%) patient continuity with a mean of 47.3% ± 14.4%. Those residents who attended more than 1 clinic per week had a median 52.1% (IQR, 49.5%–66.7%) patient continuity compared with a median of 44.6% (IQR, 33.8%–54.6%, $P = .03$) for residents attending 1 or less clinic per week. It is noteworthy that no first- or second-year resident attended an average of 1 clinic per week; indeed, first- and second-year residents attended a median of 6 (IQR, 6–7) clinics in 9 weeks while third-year students attended a median of 12 (IQR, 11–13) clinics in 9 weeks.

Unadjusted linear regression analysis showed that patient continuity increased by 2.3% ± 0.7% for each additional clinic during this 9-week period (TABLE 1). This corresponds to an increased patient continuity of 20.9% ± 6.5% for 2 clinics per week and to an increased patient continuity of 0.4% ± 0.1% for each additional clinic per year. Based on this variable alone, residents would need on average 9 clinics per 9 weeks, or at least 1 clinic actually attended per week, to achieve 50% continuity. Based on the r^2 analysis, the number of clinics explained approximately 22% of the variance in percent continuity. Unadjusted linear regression analysis showed that patient continuity decreased by 0.7% ± 0.4% for every additional 10 patients in their panel (TABLE 1). Based on this variable alone, a panel size of 67 patients would achieve 50% continuity for patients. Panel size explained approximately 10% of the variance in patient continuity. Based on the r^2 analysis, the attending physician factor explained approximately 51% of the variance in patient continuity (TABLE 1).

In a multivariable analysis that included the number of clinics and panel size (TABLE 2), patient continuity increased by 3.5% ± 0.6% per each additional clinic in this 9-week period and 0.6% ± 0.1% for each additional clinic per year. Conversely, patient continuity decreased by 1.4% ± 0.3% for every additional 10 patients in the panel. When the number of clinics (9 clinics per 9 weeks) and the panel size (67 patients) suggested by the unadjusted analyses were put into this multivariable model, patient continuity was 55.4%. Moreover, to achieve 50% patient continuity with 1 resident clinic per week, the resident panel size would need to be limited to approximately 106 patients when both variables are included in the same model. Based on the r^2 analysis, these 2 variables together explained approximately 51% of the variance in patient continuity.

When indicator variables of attending physicians were added to the multivariable model, patient continuity increased 3.3% ± 0.5% for each additional clinic per 9-week period or 0.6% ± 0.1% for each additional clinic per year. Conversely, patient continuity decreased by 2.2% ± 0.4% for each additional 10 patients in the resident panel

TABLE 2 **Multivariable Analysis of Resident Continuity**[a]

Variable	Intercept	β Coefficient	*P* Value	r^2
Model 1	33.3 ± 5.0			0.506
Clinics				
Number per 9 weeks		3.5 ± 0.6	<.001	
Number per week		31.1 ± 5.6	<.001	
Number per year		0.6 ± 0.1	<.001	
Panel Size (number of patients)		−0.14 ± 0.03	<.001	
Model 2	26.2 ± 5.3			0.793
Clinics				
Number per nine weeks		3.3 ± 0.5	<.001	
Number per week		29.7 ± 4.9	<.001	
Number per year		0.6 ± 0.1	<.001	
Panel size (number of patients)		−0.22 ± 0.04	<.001	
Attending physician		Variable: 0 to 36.9	<.001	

[a] Plus and/or minus values are means ± standard error.

size (TABLE 2). The β coefficients for the attending physicians range from 0% to 36.9%. Thus, when 1 clinic per week and 106 patients were entered into the multivariable model, patient continuity ranged from 33% to 70%, depending on the attending physician. All 3 variables explained approximately 79% of the variance in patient continuity.

For our sensitivity analyses, we found no significant changes in the outcomes when we removed the resident who appeared to have disproportionate leverage or when we removed residents who were reassigned to new attending physicians (data not shown).

Discussion

In this academic general internal medicine clinic, we found that percent continuity for patients followed by residents was significantly affected by the number of resident clinics, the panel size for the residents, and the attending physician. When analyzed separately, patient continuity increased 2.3% for each additional clinic in this 9-week period or 0.4% for each additional clinic during a year. Thus, the ACGME requirement to increase the number of continuity clinics for residents should have a beneficial effect on patient continuity. Conversely, patient continuity decreased 0.7% for every 10 patients added to the panel size. Indeed, even during this relatively stable period in the academic year, residents who attended more than 1 clinic per week had significantly better median patient continuity than residents who attended 1 clinic or fewer per week. These results are in keeping with prior pediatrics literature that showed an increase from 1 to 2 clinics per week was associated with an 11% increase in resident continuity.[13] This study measured continuity form the resident perspective, but we measured continuity from the patient perspective, in keeping with the Institute of Medicine goal of patient-centered care. Even in an academic medical center, we believe that we must make the shift from a physician-centric system, which measures continuity from the perspective of the resident/physician, to one that is patient-centered but resident-sensitive. It is reassuring to note, however, that an increased number of clinics leads to improved continuity, from the perspective of both patients and residents.

When the number of clinics and the panel size were more appropriately analyzed together, our data suggest this relationship among the variables in our clinic: percent continuity for patients = 33.3 + 0.6 (number of clinics per year) − 0.14 (panel size). Understanding these relationships will enable program directors to adjust either the number of resident clinics or the resident panel size to achieve the desired percent continuity for patients. Thus, to achieve 50% patient continuity with 1 resident clinic per week, resident panel size would need to be limited to approximately 106 patients. However, resident panels need to be sufficiently large to expose residents to enough patients with different illnesses to ensure adequate learning. If, then, we increase resident panel size to 150 patients, for instance, our model suggests that residents would need to

attend 5 clinics per month to maintain 50% patient continuity. It is also important to note that during this relatively stable 9-week period, no first- or second-year residents in this study actually attended the full 1 clinic per week scheduled because of residency work restrictions and other conflicts. Indeed, all residents attended on average two-thirds of their theoretically available clinics. Thus, whether to maintain 50% patient continuity or to fulfill the new ACGME requirements, program directors will need to consider alternative strategies when scheduling outpatient clinics to ensure 130 clinics over 3 years.

In addition to these variables, our data indicate that the attending physician has considerable impact on the patient continuity in the resident clinic. Indeed, who the attending physician is explains more variability in patient continuity than the number of resident clinics or resident panel size. Moreover, in the model that includes attending physicians, the attending physician can influence patient continuity by 36.9%. It is not yet clear why attending physicians have such a strong impact. One possible explanation is that the emphasis or de-emphasis attending physicians place on patient continuity is then internalized by the residents they mentor. This in turn may be affected by the number of clinics and panel size of the attending physician. Alternatively, the availability of attending physicians to independently evaluate patients, followed by the resident on the days when the resident is not scheduled to be in clinic, may affect patient continuity.

There are limitations to our study. Given the small sample size of this study and the negative sensitivity analyses, the significance of these observations suggests that the influence of these variables is likely robust, but it is important to emphasize that these data are derived from a single, academic medical center. Moreover, an important limitation in our study is its 9-week duration. Although we anticipate that patient continuity will be optimal during this period, further studies are necessary to determine whether our findings generalize to other times of the year. It is also not yet clear how generalizable our observations will be in other settings. We anticipate the main findings will be replicable in other settings: that patient continuity will increase with the number of clinics, decrease with increasing panel size, and vary according to the attending physician. However, we also anticipate that the degree of these changes may vary significantly depending on how different outpatient clinics are managed, how residents are assigned to attending physicians, differences in patient populations served, and so forth. We anticipate that the model that includes only the number of clinics and panel size, percent continuity for patients = 33.3 + 0.6 (number of clinics per year) − 0.14 (panel size), will give the best first approximation to patient continuity in other settings. If, as we anticipate, the significant influence of attending physicians on patient continuity is present in other settings, then it is important for programs to monitor patient continuity by individual residents and their attending physicians and make appropriate adjustments to the number of clinics and panel size to achieve appropriate patient continuity.

There is no agreed upon level of patient continuity that is considered appropriate. Thus, our initial a priori threshold of 50% patient continuity is an arbitrary starting point and by no means represents an ideal goal. It is unrealistic for resident physicians to achieve 100% patient continuity, however, because patients will have urgent health problems that occur on days when residents are not in clinic. As residency programs explore different means of providing continuity experience for their residents, such as block and immersion models, it will be important to measure the effects of these models on patient continuity. We acknowledge that continuity between provider and patient alone is not sufficient for the development of a continuous healing relationship. There are, of course, other factors that we do not address in this study, such as communication style and rapport, that undoubtedly play a significant role in the establishment of a continuous healing relationship. Moreover, patient continuity likely has a significant impact on the continuous healing relationship, patient satisfaction, patient outcomes, resident satisfaction, and resident learning. Thus, an Educational Innovations Project work group has recently been formed to study these relationships. The Educational Innovations Project is a multi-institutional collaboration of internal medicine residency programs chosen by the ACGME to facilitate innovations in graduate medical education. As stated on the ACGME website,[16] one of the major objectives of this program is to create program-wide innovations in residency training programs directed toward advancing safe, high-quality, patient-centered care coupled with competency-based residency education.

As the population ages and more patients need to be treated for chronic diseases, continuity will become increasingly more important. Older patients especially value continuity, as do patients who need more frequent appointments because of their chronic diseases.[3,4] This is the population we serve in internal medicine. Continuity of care is essential to create continuous, healing relationships between residents and the patients they serve. We need to foster these continuous relationships for our residents if we are to encourage residents to pursue ambulatory care and to maintain continuity with their patients after their training is completed. Thus, in training our residents, we must assure that continuity of care in the ambulatory setting is taken into account when we design our systems and make our schedules. We need to actively consider the optimal panel size, the composition of the panel, and the appropriate number of clinics that will provide our residents with a variety of learning opportunities while maximizing patient continuity.

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